PHILOSOPHY OF THE DESIGN

The objective of the [redacted] project was to develop 50X1
a storage device with as few moving parts as possible and without a resupply or disposal problem, simple and direct in operation, by which a message could be prepared in relative calm and then transmitted with minimum on-the-air time. The device was at first thought of as an outgrowth or adaptation of the small and inexpensive [redacted] "on-li 50X1
keyer, which generated a character in teletype code each time one of its twelve keyboard buttons was depressed, but which suffered from lengthy transmission time, since the message could be sent only at the operator's own button-pressing speed.

During the study phase, the similarity of portions of the most practical approaches to the actual system of operation of teletypes was immediately apparent, and it was resolved to choose those alternatives which could lead directly to the development of a complete pocket-size teletypwriter, capable of receiving and storing messages for later reading$ as well as transmitting messages stored by the operator. It was hoped that a message reading device, either electrical or electro-mechanical, could be developed in place of the teletype's page printer or tape reperforator. It became practice to leave provisions for these refinements as the development proceeded, and when the ten-lamp readout device was worked out, it was added to the main circuit without difficulty.

An early design objective was division of the circuit into separate interconnected "cigarette packs". Therefore, related circuits were gathered together and made more or less independent, so that

the number of interconnections would be minimized. Although it was eventually decided to build at least the first models in a single case, the effort provided unexpected benefits, because during the development it was possible to make drastic improvements in one area of the circuitry without undue consideration of adverse effects on other circuits, and because, during checkout of a completed prototype, it is possible to isolate parts of the circuit and cause them to operate independently, so as to find a trouble rapidly. ~~Each~~ Division into packs is possible if connector reliability and operating complexity is considered.

The 60 wpm transmission rate, with one character being sent every two-tenths of a second, is in reality a very "slow" speed for a computer circuit, since information is removed and restored in the memory at the rate of one character in thirty millionths of a second. During the interim, almost all circuits are inactive. Advantage was immediately taken of this, with simple self-bias and bypass capacitors taking the place of low impedance supply points, and with frequent use of under-rated transistors. 1600 wpm operation was never precluded, however, and tests of the breadboard were made at this and slightly higher speeds. Under-rated transistors are now being eliminated, [redacted], and much higher speeds may be possible pending use of a heavy-duty power supply.

The [redacted] project uses a coincident current memory, which is smaller and less expensive than an equivalent linear selection memory, but which requires closer tolerances on the current pulses which insert and remove information. A fundamental question was whether or not transistor circuitry operating from flashlight batteries at extremes

50X1

of environment could provide pulses of the required tolerance. A second question involved the design of a sense amplifier capable of separating the memory signal from the almost-equal noise which exists in the outputs of such a memory, and amplifying it to a usable level. (The characteristic output of a linear selection memory is easier to handle.) Finally, in the case of either approach, parallel information storage (one complete character in or out of the memory at a time), which is saving of labor, size, and components, would require five sense amplifiers (four, using abbreviated code) instead of one. Any sense amplifier design must therefore have very low power drain in comparison with those in general use. Feasibility of the coincident current approach was assured when a very stable and simple pulse generating transistor-core circuit, with only six or so components and great versatility, and a locked, strobed, double-function, low current sense amplifier with single transistor, were developed.

At this time, work was started on memory construction techniques with labor, reliability, and size formost, and on development of a small, highly regulated, efficient power supply for operation from a 3-to-2 range of battery voltages.

(no paragraph)

The memory and its scanning registers, which are interconnected by scores of fine wires, were developed into a compact assembly of modular units. The sandwiched aperture plates were separated by films of teflon tape, and a greased needle was used in applying drive wires, resulting in entirely short-free construction to date. All frustrating construction operations were eliminated, and further simplification is planned.

The power supply which was developed used an adaptation of the usual dc-dc converter circuit; in this case, one complete cycle of conduction was triggered on demand so as to maintain fixed output voltage despite load and battery fluctuations. When various starting problems and noise pulses had been dealt with, the circuit was somewhat more complex than desired, but it was unusually stable and efficient. The use of triggering-on-demand results in a very low idling battery drain, and this was the reason for the design. During typing of a message, a operating current is possible in the This would relieve the operator 50X1 of any haste out of concern for battery life, but only if the type of power supply used has low idling drain. A design compromise in the at present prevents realization of much lower current in 50X1 TYPE than SEND, but this may soon be improved. A ringing-choke power supply, also triggered on demand, is undergoing promising development, and may eliminate 2/3 of present components.

The early keyboard of the which is sealed, reliable, 50X1 and small, but lacking in "feel", was utilized in several schemes for producing a touch typable, comfortable typwriter keyboard. The "cricket" principle was eventually mated with the button assembly with great success and uniformity. This design makes use of the finger itself as an element of mass and elasticity for snap action. The sealed electrical portion is hermetically sealed from the button assembly. The action may possibly be made silent. Enough mechanical "feel" now exists to make audible thumps unnecessary.